100 percent of California's surface water systems are overallocated…

Whiskey is for drinking…
water is for fighting.
- Mark Twain

Groundwater – Unplugged.

- Essentially unregulated at state level (a *little* regulated after 2014…)
- Recognizes overlying rights (~riparian) and appropriative rights, similar to surface water.

Groundwater – Unplugged

Los Angeles v. Pomeroy (Cal. 1899)

- City condemns land along LA River through eminent domain – Court finds City has paramount right to water of the river.
- Groundwater beneath the river constitutes a "*subterranean stream*" – part of the LA River.
- Water moving generally through a broad basin of interconnected alluvial deposits does "not constitute a watercourse." Court creates term "*percolating groundwater*."

Groundwater – Unplugged

California Water Code § 1200:

"Whenever the terms stream, lake or other body of water, or water occurs in relation to applications to appropriate water or permits or licenses issued pursuant to such applications, such term refers only to surface water, and to subterranean streams flowing through known and definite channels."

State Water Resources Control Board has no permitting authority. Except…

Groundwater – Legal options.

Cal. Constitution, article 10, sec. 2.

"It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare."

Groundwater – Legal options.

Court adjudications - Courts have adjudicated settlements ordering the distribution of available water for nineteen groundwater basins in California, mostly in southern California.

2014 – Sustainable Groundwater Management Act

nat·u·ral re·sources

noun

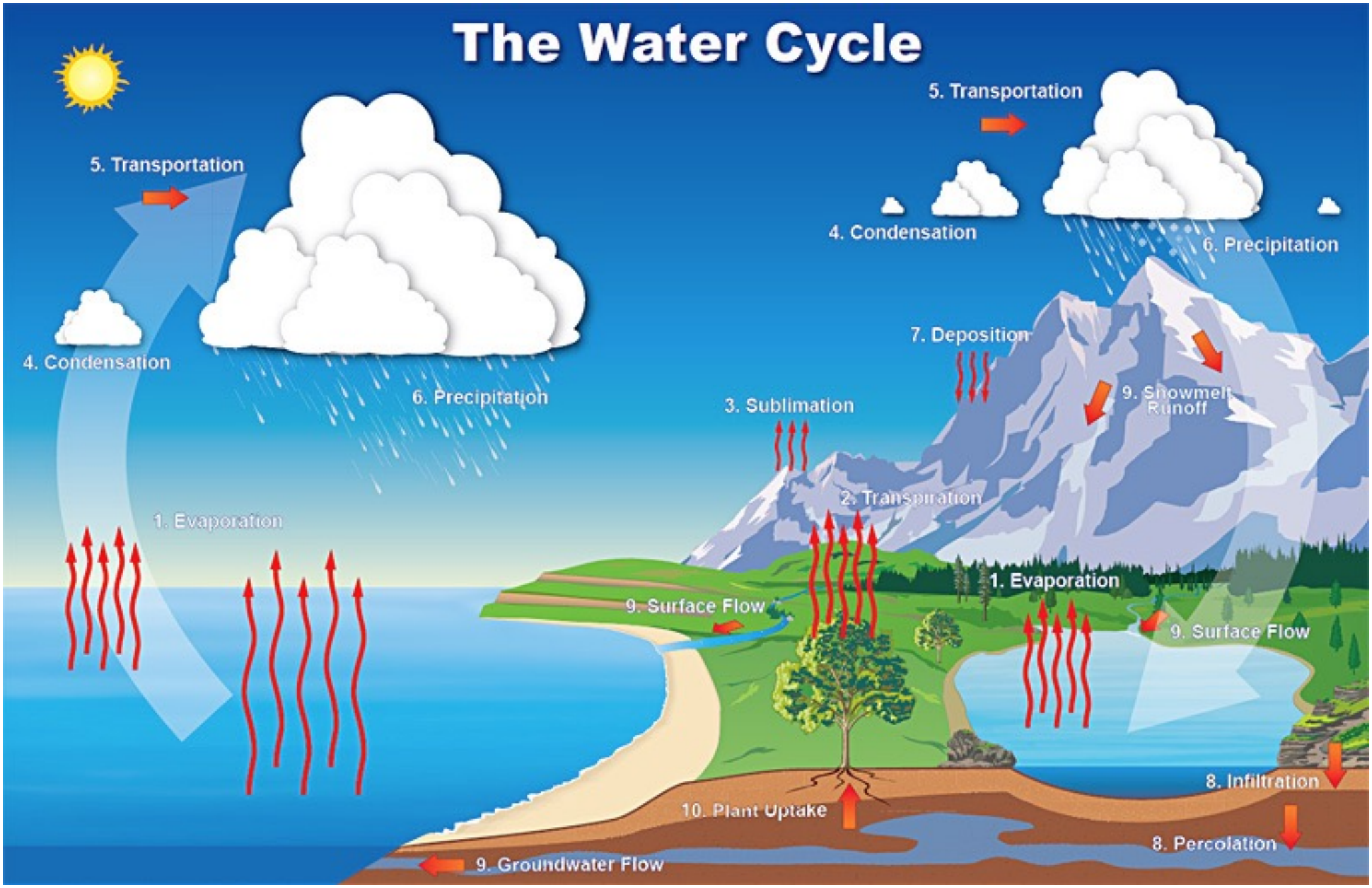
noun: **natural resource**

materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain.

A renewable resource is an organic natural resource that can replenish *in due time compared to the usage*, either through biological reproduction or other naturally recurring processes.

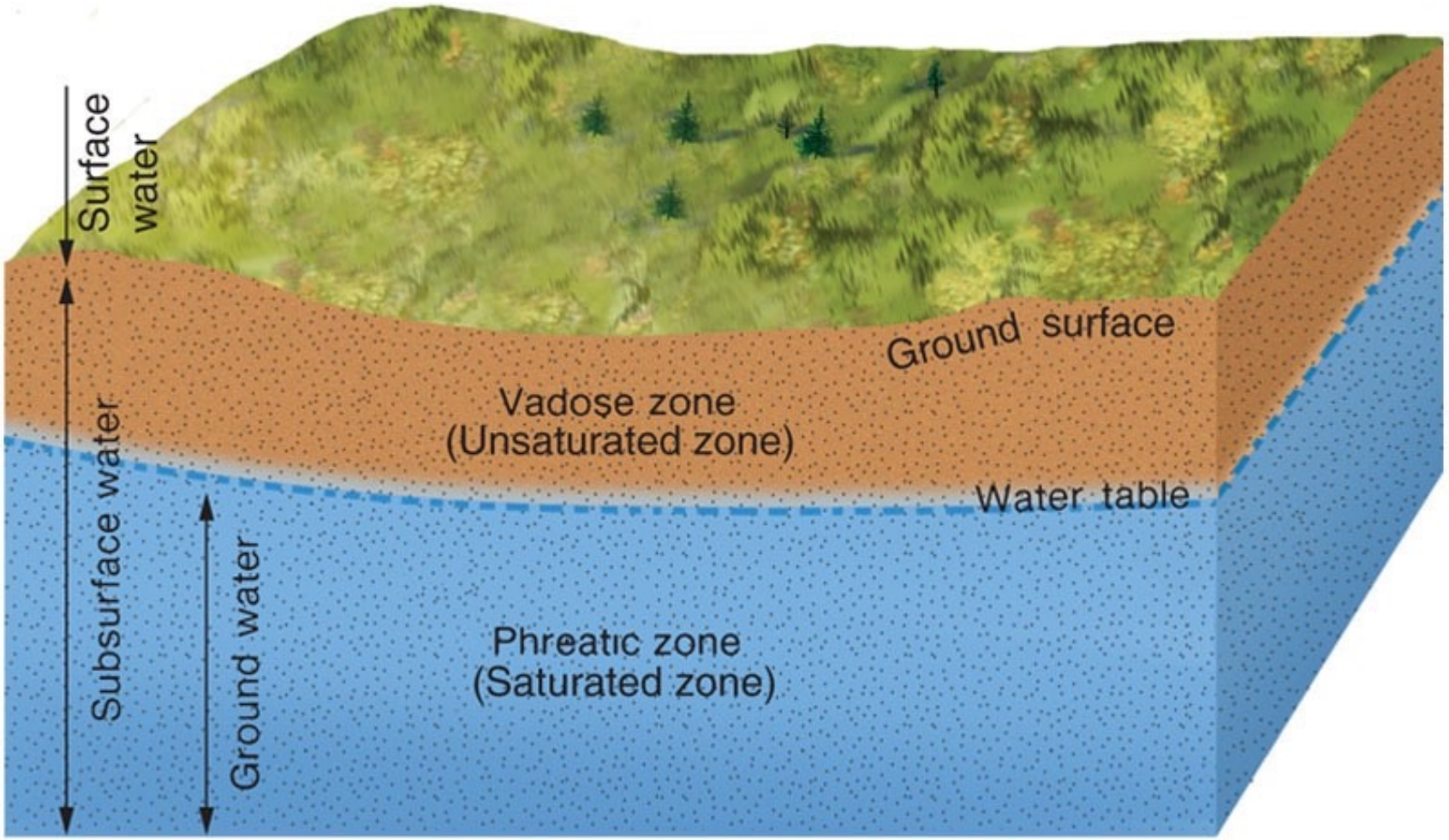
Renewable resources are a part of Earth's natural environment and the largest components of its ecosphere.

Groundwater is often considered to be one of the last 'free' resources, as anyone who can afford to drill, can draw up merely according to their ability to pump.

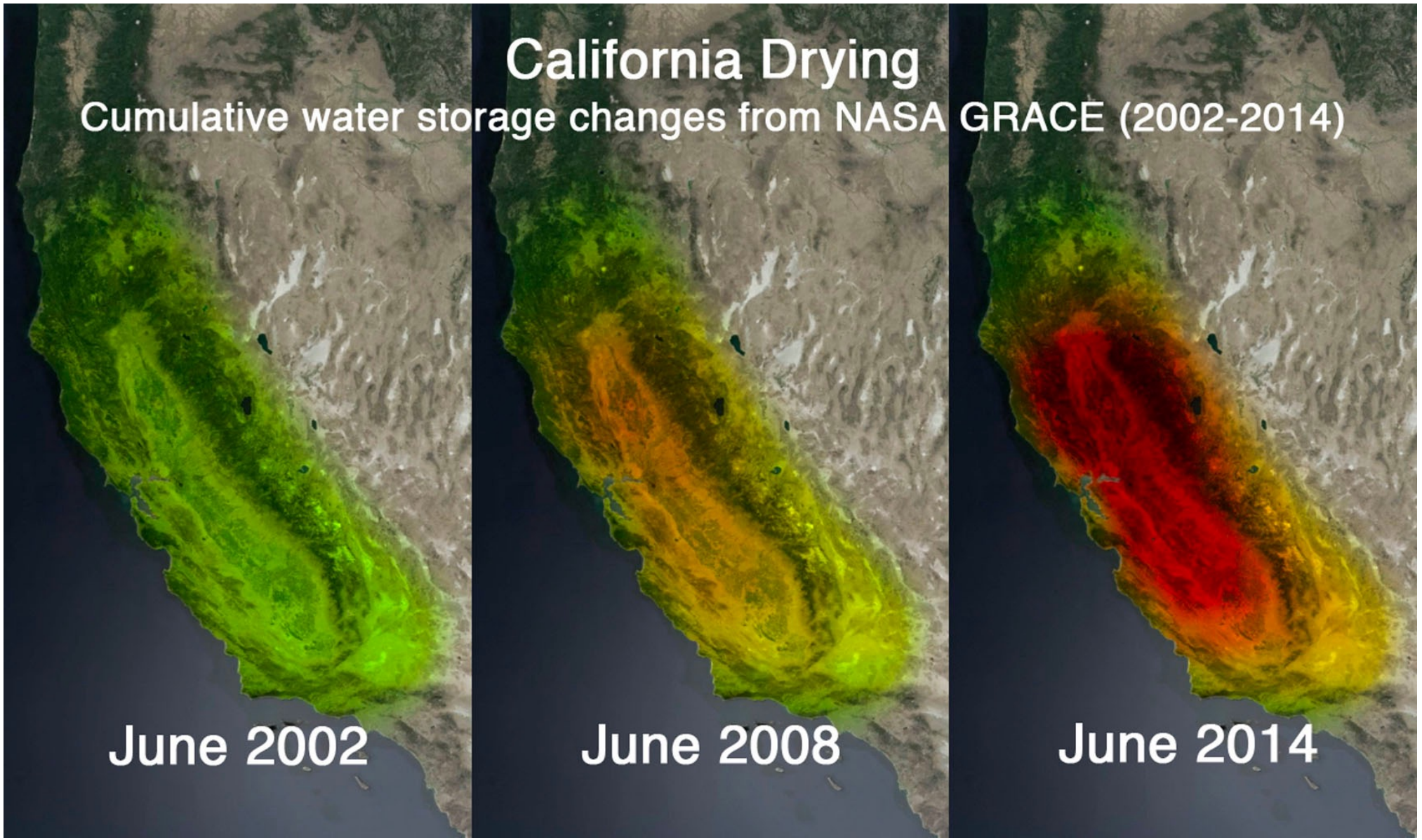

The Water Cycle
5. Transportation
4. Condensation
6. Precipitation
5. Transportation
4. Condensation
6. Precipitation
7. Deposition
9. Snowmelt Runoff
3. Sublimation
2. Transpiration
1. Evaporation
9. Surface Flow
1. Evaporation
9. Surface Flow
8. Infiltration
10. Plant Uptake
8. Percolation
9. Groundwater Flow

NOAA

Water Table


Surface water
Subsurface water
Ground water
Vadose zone
(Unsaturated zone)
Ground surface
Water table
Phreatic zone
(Saturated zone)

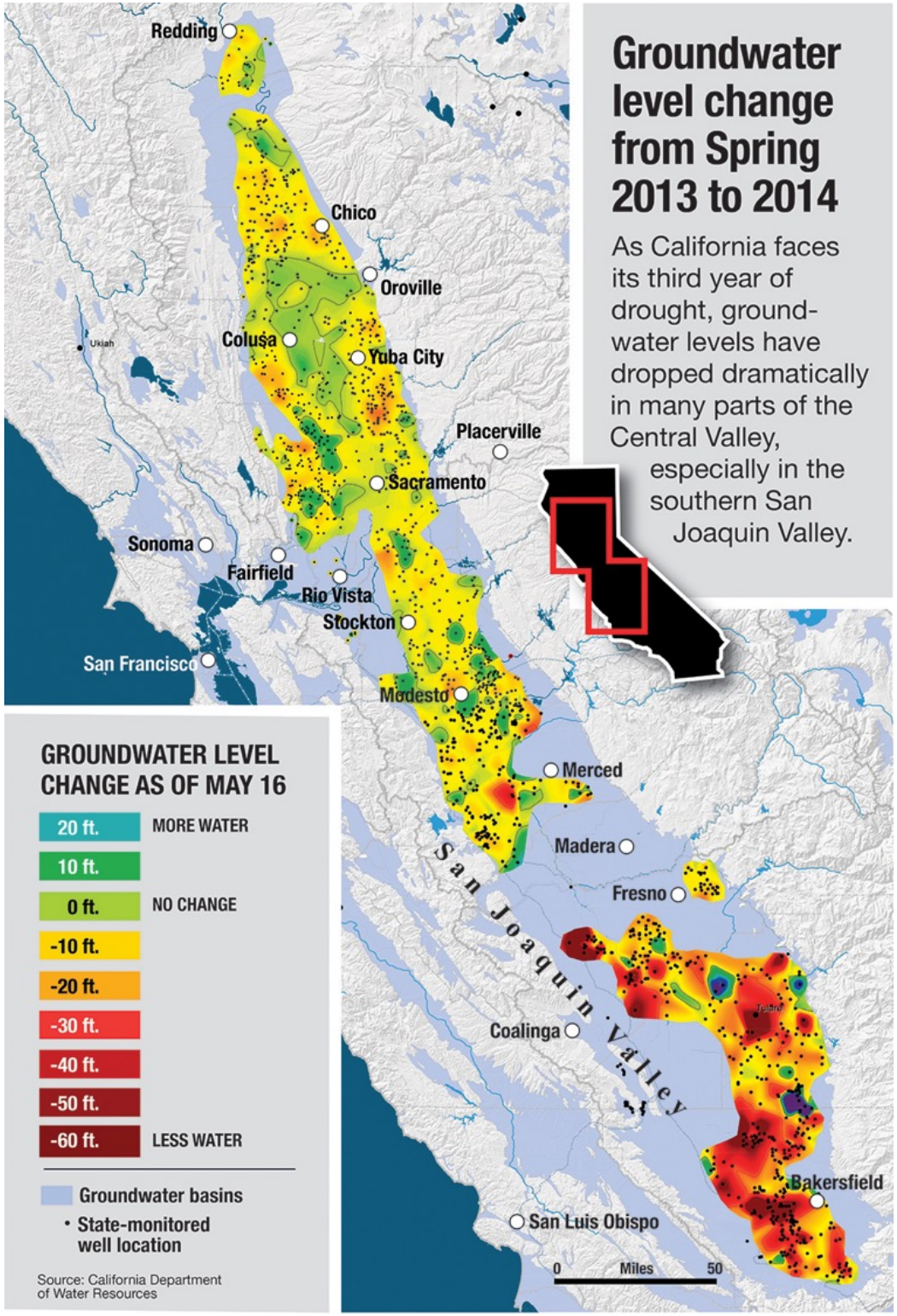
Redding
Sacramento River
Chico
SACRAMENTO VALLEY
NEVADA
Yuba City
Sacramento
Carquinez Strait
DELTA & EASTSIDE STREAMS
Stockton
Modesto
SAN JOAQUIN BASIN
Merced
San Joaquin River
DELTA-MENDOTA CANAL
Fresno
Joaquin
Visalia
Valley
TULARE BASIN
PACIFIC OCEAN
CALIFORNIA AQUEDUCT
Bakersfield


California Drying
Cumulative water storage changes from NASA GRACE (2002-2014)
June 2002
June 2008
June 2014

Overdraft:

Groundwater levels are decreasing throughout California as a result of drought and unsustainable pumping.

Annual groundwater overdraft in the San Joaquin Valley region from1988-2017 period was nearly 2 million acre-feet (maf) - 11% of net water use

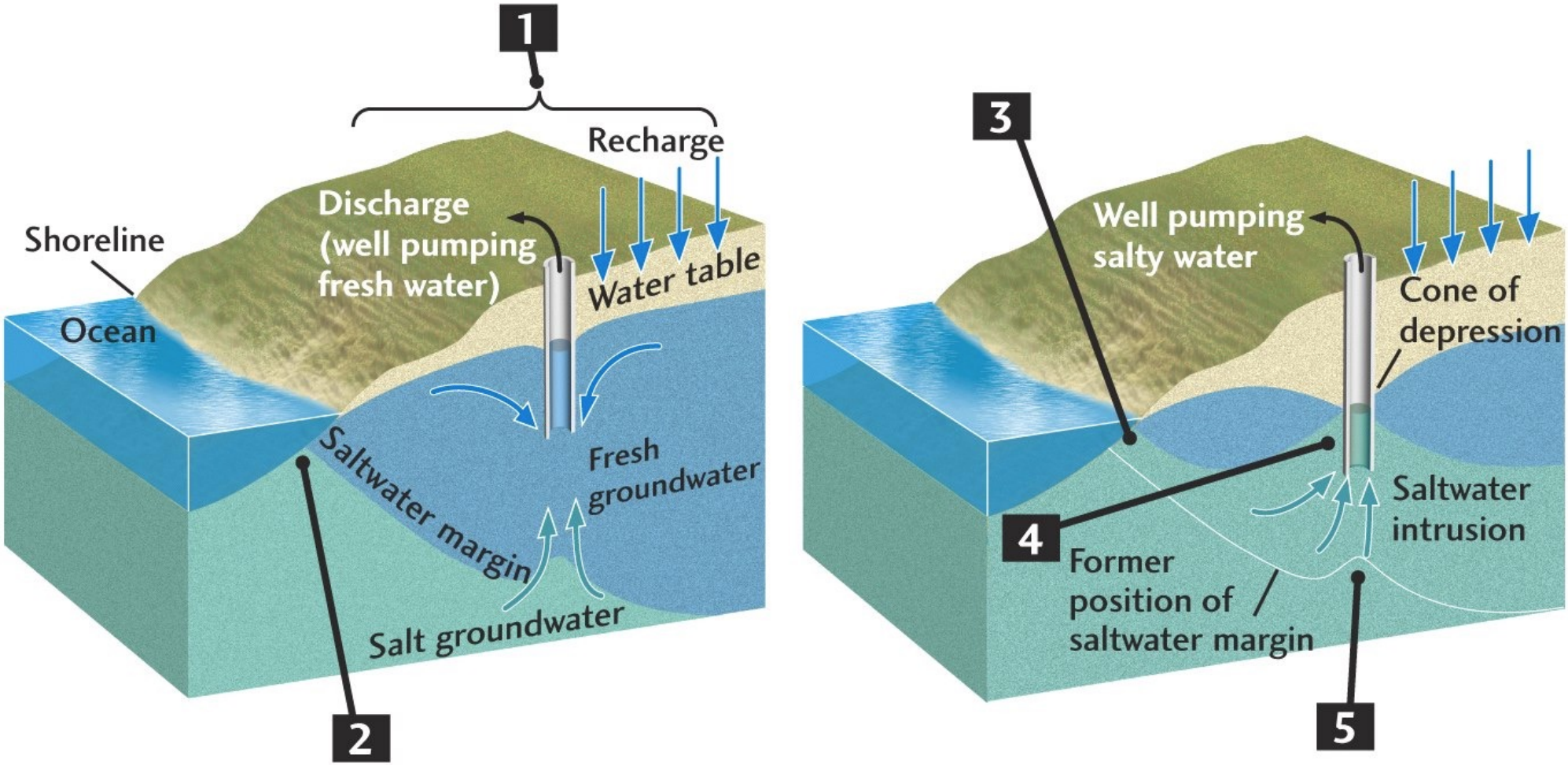


Ground subsidence in the Central Valley from overdraft.

1955
SAN JOAQUIN VALLEY
CALIFORNIA
BM SS61
SUBSIDENCE 9M
1925-1977
1977

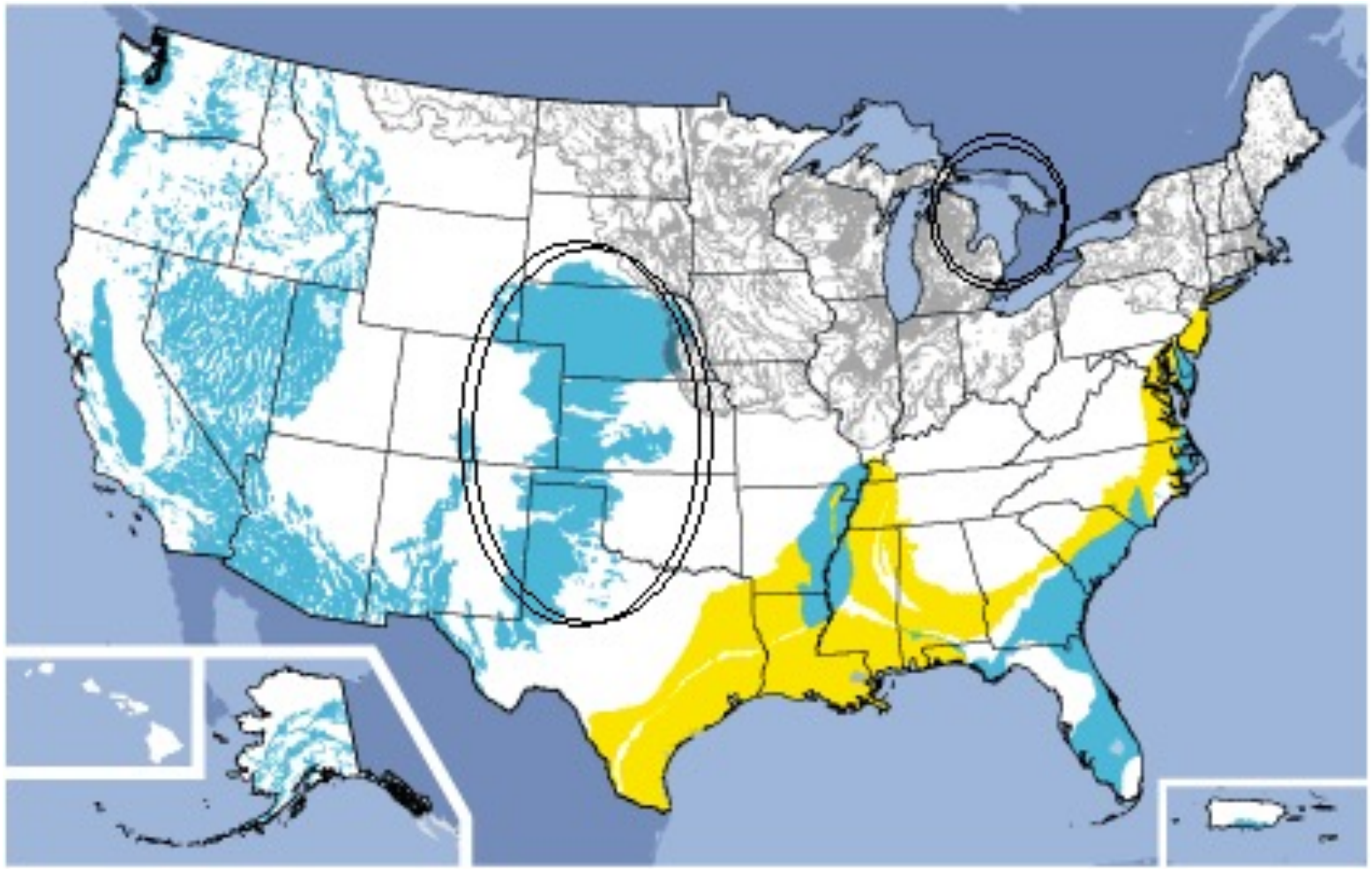
1988
SAN JOAQUIN VALLEY, CA
SUBSIDENCE 6.2 ft
1988-2016
Benchmark
USGS
2004
2008
2016

Groundwater – saltwater intrusion

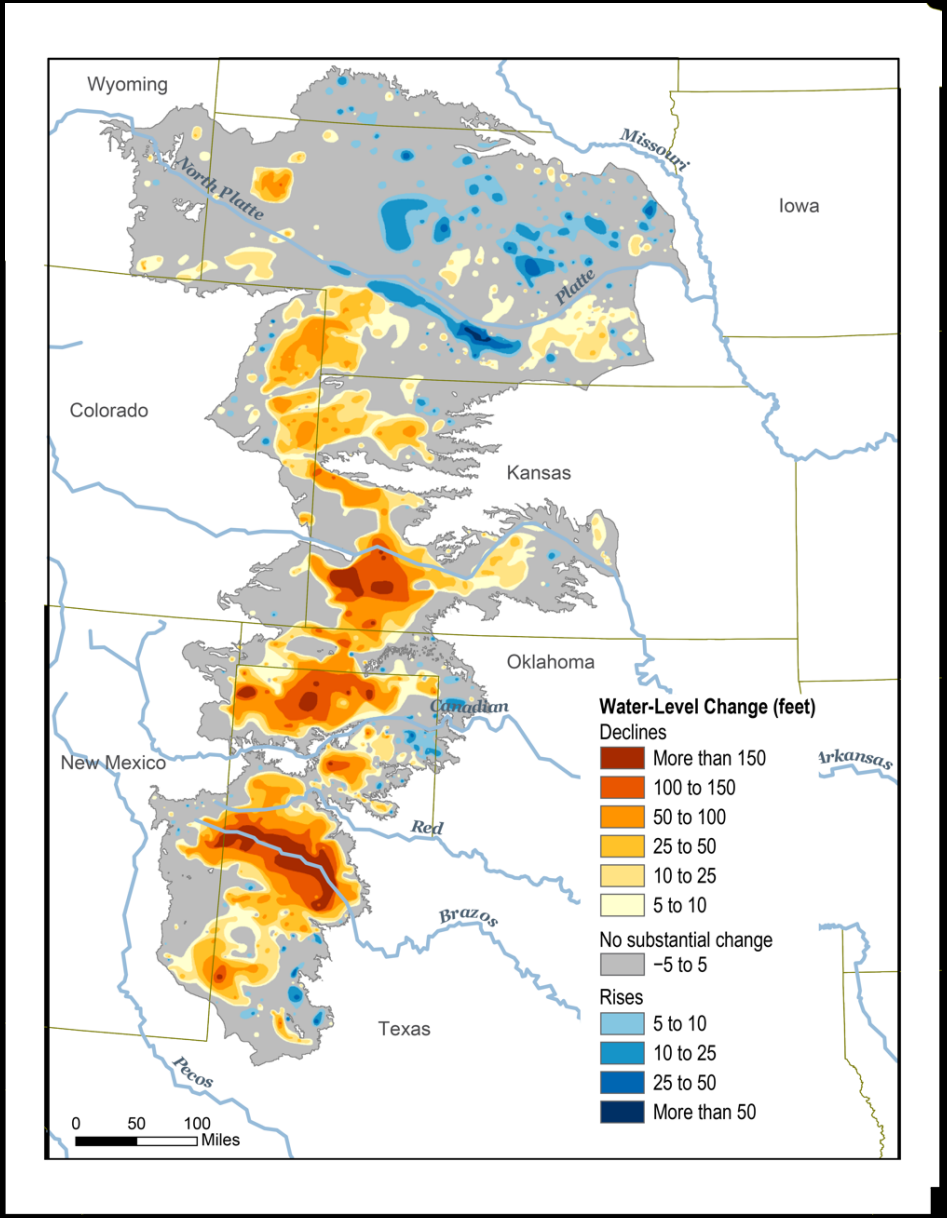


Groundwater Overdraft – Dewatering

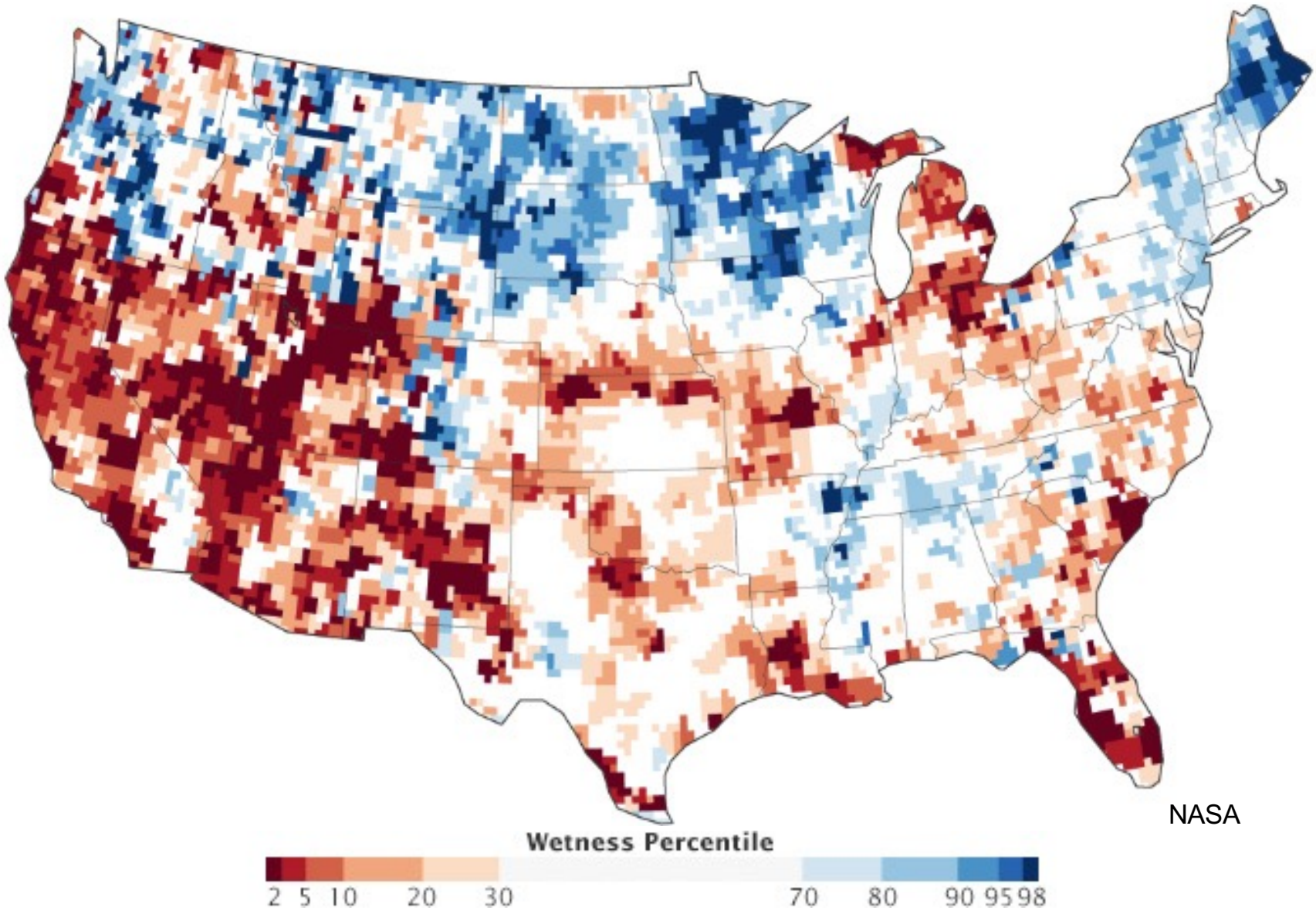
Ogallala Aquifer - Overdraft



- OVERDRAFT:
- Changes in Ogallala water table from pre-development to 2015
- This provided much of the water for the US “breadbasket”

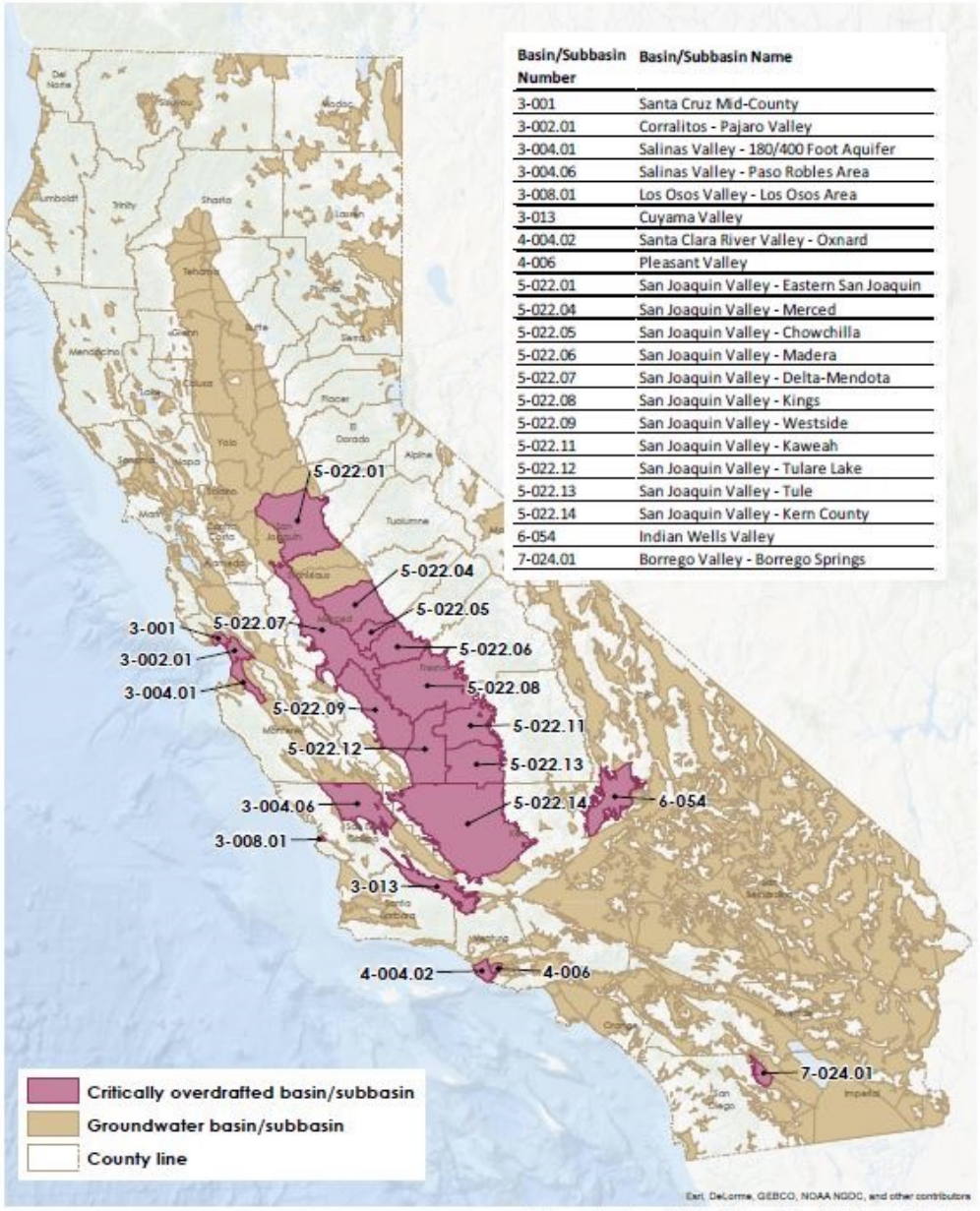


Amount of groundwater in July 2014 compared to average from 1948-2009.



NASA

Bulletin 118 Groundwater Basins Subject to Critical Conditions of Overdraft – Update based on 2018 Final Basin Boundary Modifications


Basin/Subbasin Number
Basin/Subbasin Name
3-001 Santa Cruz Mid-County
3-002.01 Corralitos - Pajaro Valley
3-004.01 Salinas Valley - 180/400 Foot Aquifer
3-004.06 Salinas Valley - Paso Robles Area
3-008.01 Los Osos Valley - Los Osos Area
3-013 Cuyama Valley
4-004.02 Santa Clara River Valley - Oxnard
4-006 Pleasant Valley
5-022.01 San Joaquin Valley - Eastern San Joaquin
5-022.04 San Joaquin Valley - Merced
5-022.05 San Joaquin Valley - Chowchilla
5-022.06 San Joaquin Valley - Madera
5-022.07 San Joaquin Valley - Delta-Mendota
5-022.08 San Joaquin Valley - Kings
5-022.09 San Joaquin Valley - Westside
5-022.11 San Joaquin Valley - Kaweah
5-022.12 San Joaquin Valley - Tulare Lake
5-022.13 San Joaquin Valley - Tule
5-022.14 San Joaquin Valley - Kern County
6-054 Indian Wells Valley
7-024.01 Borrego Valley - Borrego Springs
Critically overdrafted basin/subbasin
Groundwater basin/subbasin
County line
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Map created from B118 Basin Boundaries Published 02/11/2019.

CALIFORNIA DEPARTMENT OF WATER RESOURCES

21 out of 525 Groundwater Basins in California are critically overdrafted

Sustainable Groundwater Management Act (SGMA) - 2016

Goal of maintaining sustainable groundwater levels in groundwater wells; requires permitting, annual monitoring, and additional oversight efforts.

- Groundwater basins that are critically overdrafted must track any pumping activity and develop groundwater sustainability plans (GSPs).
- By January 31, 2022, all GSPs must be in effect; by 2042 critically overdrafted basins, most of which are in the Central Valley, must reach sustainable levels
- Requires some permitting and overall monitoring

PPIC Analysis of 36 Groundwater Sustainability Plans in 11 critically overdrafted basins:

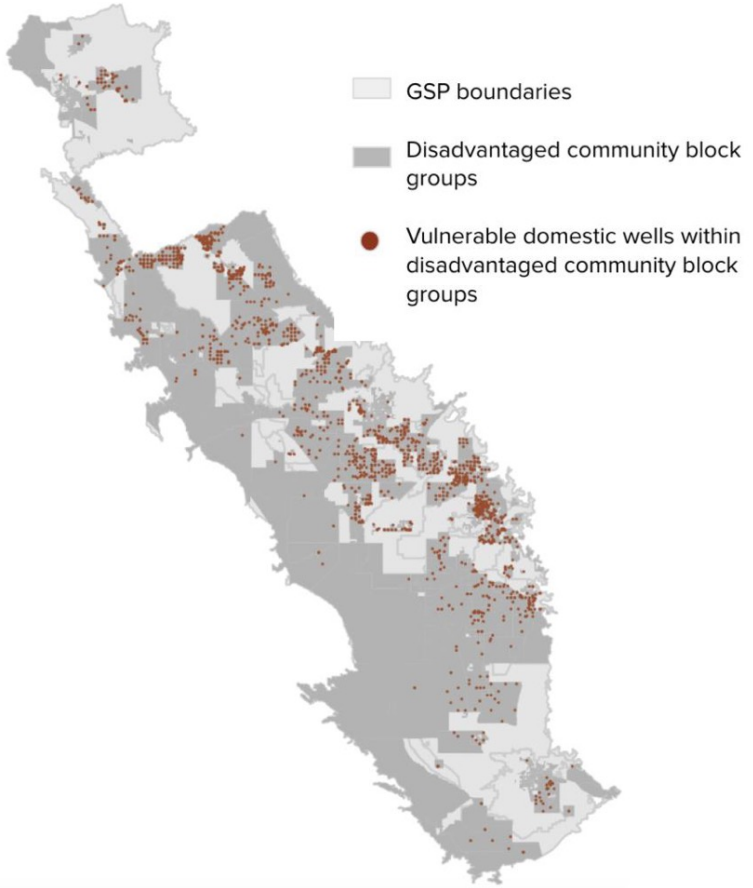
- Little consistency. Plans use different timeframes, different accounting methodologies. Makes comparison between plans difficult.
- Plans acknowledge overdraft, but underestimate it.
- Plans emphasize supply side solutions – rather than addressing demand.
- …And the assessments of potential supply options are not realistic…

How many Californians rely on private domestic wells for water?

A) 100,000
B) 250,000
C) 500,000
D) 750,000
E) More than 1,000,000

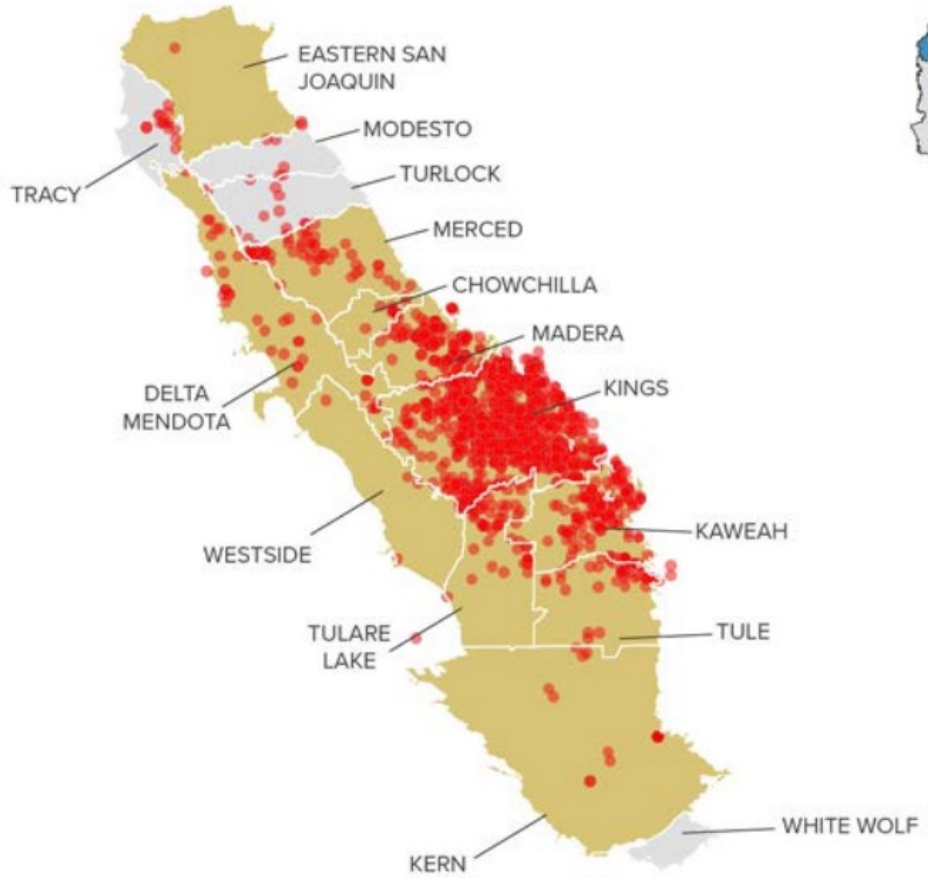
Study on SGMA and impacts to disadvantaged communities:

Disadvantaged block groups make up 60% of the area within submitted San Joaquin Valley Groundwater Sustainability Plans for critically overdrafted basins.

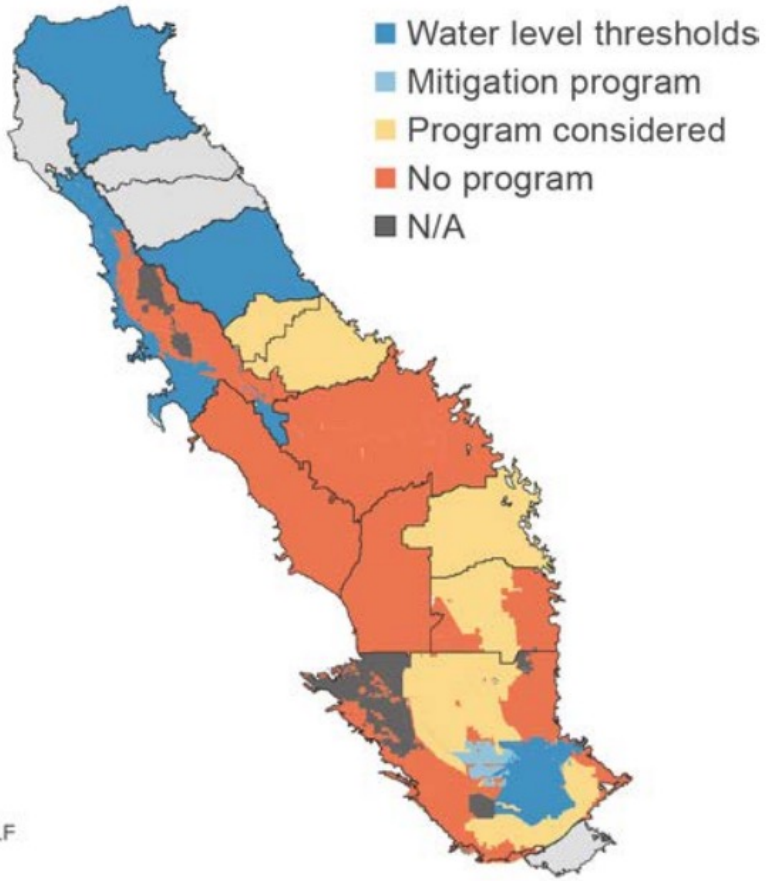

GSP boundaries
Disadvantaged community block groups
Vulnerable domestic wells within disadvantaged community block groups

Within disadvantaged block groups, there are approximately 6,300 domestic wells completed after 1990; about 2,100 (30%) of which have pumps vulnerable to minimum thresholds – an undesirable result for groundwater overdraft. The 2,100 domestic wells comprise nearly 40% of all vulnerable wells within the San Joaquin Valley.

A) Wells that went dry during 2012–16 drought



B) Well protections in groundwater sustainability plans



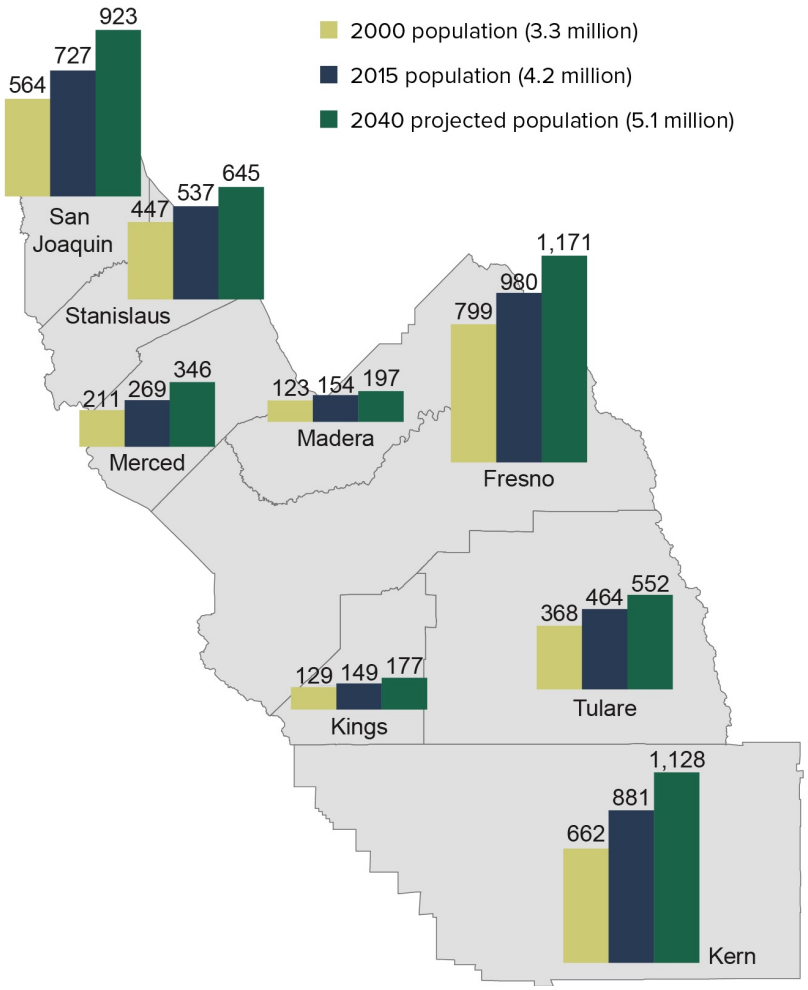
SOURCES: Jezdimirovic et al. (PPIC Blog, May 14, 2020). 2012–16 dry domestic wells: author estimates based on well completion records and groundwater elevation data downloaded from the Department of Water Resources. Domestic well protections: author estimates based on groundwater sustainability plans submitted to the Department of Water Resources.

NOTES: Analysis of dry domestic wells includes wells built after 1981; excludes wells where groundwater elevation data not available. Roughly 2,300 domestic wells went dry in San Joaquin Valley, with 2/3 in Kings Basin. Mitigation programs exist at Kern Water Bank, Rosedale Rio Bravo, Pioneer Project. Areas marked N/A have few or no domestic wells. Basins in grey (Modesto, Turlock, Tracy, White Wolf) are not critically overdrafted and have not yet completed sustainability plans.

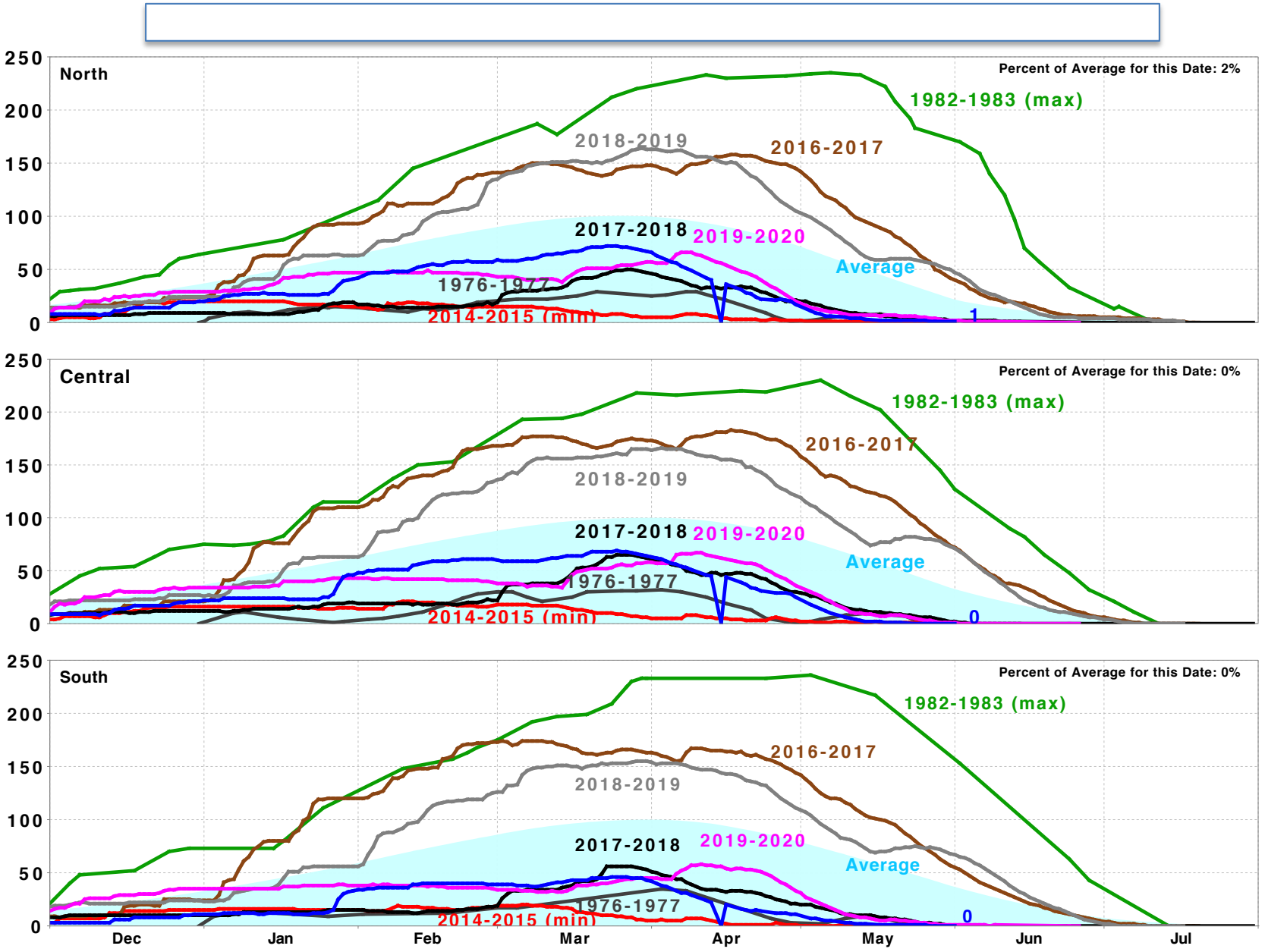
Report by Water Foundation:

Current groundwater sustainability plans could lead to as many as 12,000 wells in the San Joaquin Valley drying up by 2040, and that as many as 127,000 people could lose some or all of their primary water source in the same timeframe.

Agriculture is not the only concern



California snow water content, Aug. 30, 2021



Statewide Percent of April 1: -1%

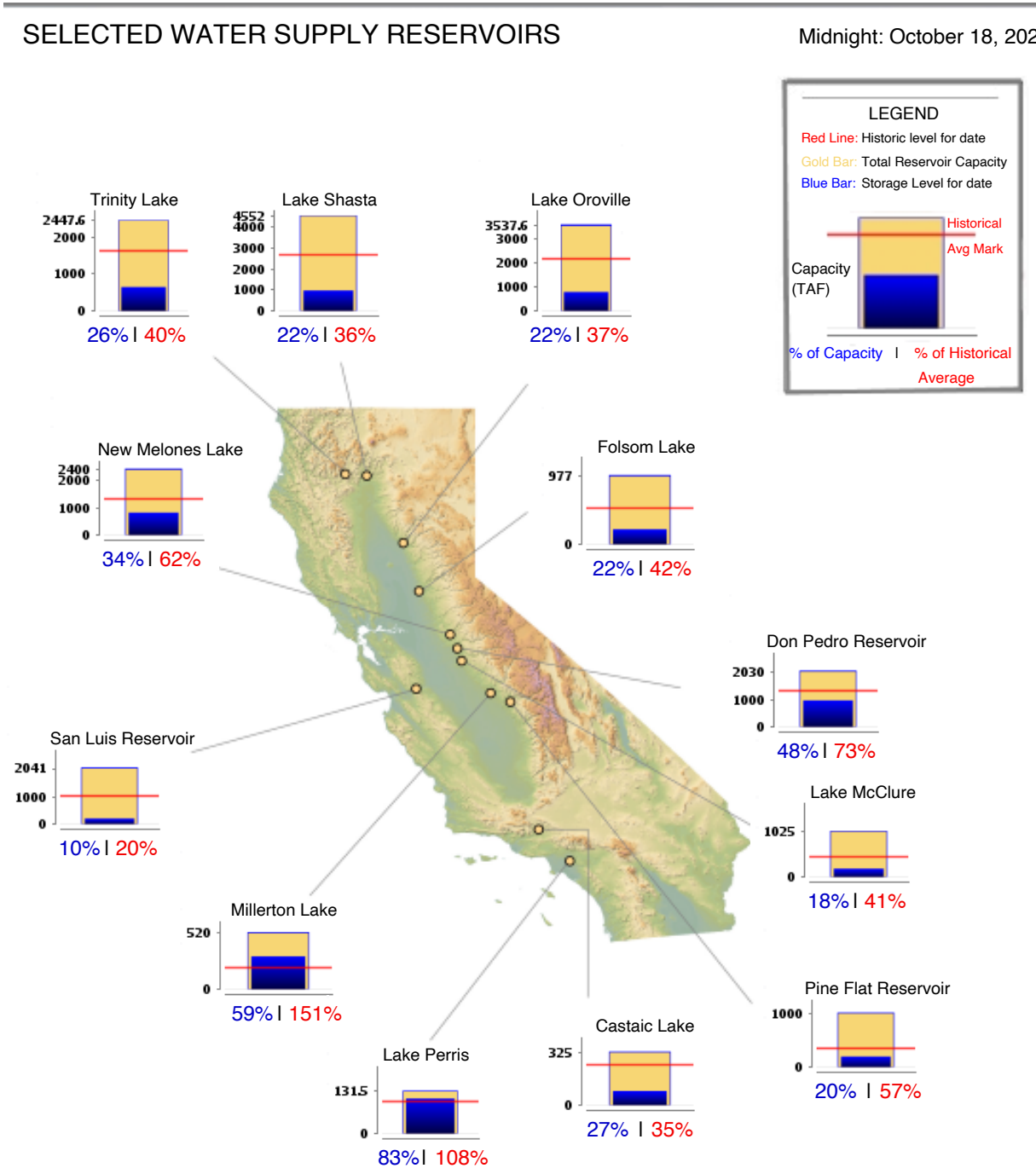
Los Angeles Times

CALIFORNIA

California records driest year in a century

Dried mud and a stranded buoy are seen on the lakebed at Lake Oroville. (Brian van der Brug / Los Angeles Times)

BY LAURA ANAYA-MORGA

OCT. 18, 2021 5 AM PT

- Current Reservoir Conditions